REMARKS

This application has been carefully reviewed in light of the Office Action dated April 06, 2004. Claims 1 to 15 are currently pending in the subject application, of which Claim 1 is the only independent claim in the application. New Claims 14 and 15 have been added, support for which is believed to be found throughout the specification, and particularly in the paragraphs beginning on page 12, line 10, and ending on page 13, line 6. Reconsideration and further examination are respectfully requested.

In the Office Action, Claims 1 to 7 and 11 to 13 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of U.S. Patent No. 6,438,273 (Loce) and U.S. Patent No. 5,930,405 (Chida); Claim 8 was rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Loce and Chida in view of U.S. Patent No. 6,317,525 (Aleksic); and Claims 9 to 10 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Loce and Chida in view of U.S. Patent No. 6,522,284 (Miceli). Applicants have carefully considered each of the rejected claims together with the applied references and respectfully submit that the claims currently under consideration are patentably distinguishable over the applied references for at least the following reasons.

The present invention concerns a method of increasing the sharpness of a source image based on at least one auxiliary, co-registered image(s) of a higher degree of sharpness. One or more auxiliary images of a field of view and the source image of the field of view comprise a plurality of pixels with corresponding spectral intensities. The spectral intensities of co-located pixels in the source and one or more auxiliary images define an intensity vector for each co-located pixel.

With reference to the particular claim language, amended independent Claim 1 is directed to a method of increasing the sharpness of a source image based on at least one auxiliary, co-

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registered image(s) of a higher degree of sharpness. One or more auxiliary images of a field of view and the source image of the field of view comprise a plurality of pixels with corresponding spectral intensities. The spectral intensities of these co-located pixels in the source and one or more auxiliary images define an intensity vector for each co-located pixel. The method includes the steps of resampling the source and the auxiliary images to a common lower resolution, determining for each source image pixel a gain relating a differential change in intensity in the source image pixel with a differential change in intensity of a corresponding auxiliary image pixel, based on the common, lower resolution, wherein determining the gain includes the steps of (1) dividing the pixels in the source image and auxiliary image into corresponding pixel groups each having a plurality of pixels, (2) calculating an average value for each pixel group in the source image and for each corresponding pixel group in the auxiliary image, (3) subtracting the average value from each pixel group to create pixel difference groups, and (4) computing the gain between corresponding pixels of each pixel difference group of the source image and the corresponding pixel difference group of the auxiliary image. The method further includes the steps of deriving a mapping function correlating determined gains with corresponding intensity vectors, subdividing each pixel of the original source image into a plurality of small pixels, each small pixel of the original source image corresponding in size and location to a small pixel in the auxiliary image, and modifying the intensity of each subdivided source pixel based on differences in intensities between the small and large pixels in the auxiliary image and an interpolated gain from the mapping function.

The applied references are not seen to disclose or suggest the foregoing features of the present invention, particularly with respect to at least the features of (1) increasing the sharpness of a source image based on at least one auxiliary, co-registered image(s) of a higher degree of sharpness, wherein one or more auxiliary images of a field of view and the source image of the

field of view comprise a plurality of pixels with corresponding spectral intensities; (2) determining for each source image pixel a gain relating a differential change in intensity in the source image pixel with a differential change in intensity of a corresponding auxiliary image pixel, based on the common, lower resolution; or (3) creating pixel difference groups, and computing the gain between corresponding pixels of each pixel difference group of the source image and the corresponding pixel difference group of the auxiliary image.

Loce is seen to be generally directed to a method of using rotatable templates within look-up tables to enhance image reproduction. Specifically, the invention in Loce employs resolution enhancement filters in the form of templates in look-up tables or logic operations. The Office Action states that these resolution enhancement filters in the form of templates correspond to the Applicants' invention in which the sharpness of a source image is increased based on at least one auxiliary, co-registered image(s) of a higher degree of sharpness, wherein one or more auxiliary images of a field of view and the source image of the field of view comprise a plurality of pixels with corresponding spectral intensities. Applicants respectfully disagree with this interpretation of Loce.

In column 1, lines 51-56 and column 2, lines 30-35, Loce describes "resolution enhancement filters in the form of templates in look-up tables or logic operations," which filters may be "designed by any of a number of methods, including but not limited to calculations that are based on geometry, statistics and expert knowledge of specific pattern shapes." In column 7, lines 2-7, Loce indicates that the "present invention may operate successfully by accessing a template that is not an exact match to the pixel states in the observation window. Rather, the template matching operation is performed by examining multiple symmetries of a pattern." This clearly indicates that these resolution enhancement filters are not co-registered images of a field of view, as they are not even images at all, but are rather filters. Applicants respectfully submit

that Loce is not seen anywhere to discuss, much less disclose increasing the sharpness of a source image based on at least one auxiliary, co-registered image(s) of a higher degree of sharpness, wherein one or more auxiliary images of a field of view and the source image of the field of view comprise a plurality of pixels with corresponding spectral intensities.

Moreover, Loce is seen to be generally directed towards an image processing system which includes a database of input patterns or templates at one resolution that may be used to generate output pixel patterns at another resolution. Specifically, resolution enhancement filters, in the form of templates in look-up tables or logic operators, operate on image bitmaps to convert them from an original resolution to an output resolution, at an integer multiple in each direction of the input resolution. The Office Action states that this change in *resolution* corresponds to the Applicants' invention, in which a determination for each source image pixel a gain relating a differential change in *intensity* in the source image pixel with a differential change in intensity of a corresponding auxiliary image pixel, based on the common, lower resolution. Applicants respectfully disagree with this interpretation of Loce.

In column 7, lines 10-15, Loce describes that the "image processing system in which the present invention is implemented will include a database of input patterns or templates at resolution M that may be used to generate output pixel patterns at resolution N." Further, Loce describes in column 12, lines 5-12 and column 1, lines 63-67, the "generation of the enhanced output for the target pixel," which enhanced output is a pixel pattern of an output resolution "at an integer multiple in each direction of the input resolution." This generation of an enhanced output with a change in *resolution* is certainly not a *gain* relating a differential change in *intensity* in the source image pixel with a differential change in *intensity* of a corresponding auxiliary image pixel, based on the common, lower resolution. Applicants respectfully submit that Loce is not seen anywhere to discuss, much less disclose determining for each source image

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pixel a gain relating a differential change in intensity in the source image pixel with a differential change in intensity of a corresponding auxiliary image pixel, based on the common, lower resolution.

Chida is seen to be generally directed to a method of storing a still image of high resolution as a reference image, against which lower resolution images, input at a later time, are compared to determine if the lower resolution images differs from the reference image. If a variance calculation determines that any portion of the low resolution image differs from the reference image, an image section in an area including the differing portion is sensed at a higher resolution, and information on the sensed image section is stored. The Office Action stated that this variance calculation corresponds to the Applicants' invention, in which pixel difference groups are created, and the gain between corresponding pixels of each pixel difference group of the source image and the corresponding pixel difference group of the auxiliary image is computed. Applicants respectfully disagree with this interpretation of Loce.

In column 9, lines 28-44, Chida describes mean difference calculating units α and β, a mean-square-error calculating unit, and a variance calculating unit which perform calculations on blocks of pixels in a low resolution image to determine if a portion thereof differs from a high resolution reference image. In column 10, lines 60-65, Chida describes the variance calculating unit, which "calculates a variance in the target block." This calculation, given by Equation (4), calculates the average or mean of all of the pixels in the target block, as Loce describes in Column 9, lines 52-57: "a mean difference of the calculated differences between all the corresponding pixels inside of those blocks is obtained, thereby obtaining a difference between those blocks." Applicants respectfully submit that Chida is not seen anywhere to discuss, much less disclose creating pixel difference groups and computing the gain between corresponding

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pixels of each pixel difference group of the source image and the corresponding pixel difference group of the auxiliary image.

Accordingly, even the hypothetical combination of Loce and Chida would not render Claim 1 obvious, as neither reference is seen to disclose or suggest at least the features of (1) increasing the sharpness of a source image based on at least one auxiliary, co-registered image(s) of a higher degree of sharpness, wherein one or more auxiliary images of a field of view and the source image of the field of view comprise a plurality of pixels with corresponding spectral intensities; (2) determining for each source image pixel a gain relating a differential change in intensity in the source image pixel with a differential change in intensity of a corresponding auxiliary image pixel, based on the common, lower resolution; or (3) creating pixel difference groups, and computing the gain between corresponding pixels of each pixel difference group of the source image and the corresponding pixel difference group of the auxiliary image

Aleksic and Miceli, which were applied in the rejections of certain dependent claims, are not understood to disclose or suggest anything to remedy the foregoing deficiencies of Loce or Chida.

Accordingly, independent Claim 1 is believed to be allowable over the applied references. Reconsideration and withdrawal of the § 103(a) rejection of Claim 1 is respectfully requested.

The other claims currently under consideration in the application are dependent from the independent claims discussed above and therefore are believed to be allowable over the applied references for at least the same reasons. Because each dependent claim is deemed to define an additional aspect of the invention, however, the individual consideration of each on its own merits is respectfully requested.

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In view of the foregoing amendment and remarks, all of the claims currently under consideration in the application are believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' undersigned attorney may be contacted at the address and telephone number set forth below.

Respectfully submitted,

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